TASC Summary of December 2014 USGS Groundwater Report

Introduction

The 200-acre West Lake Landfill (WLL) Superfund site includes two landfills that received soil contaminated with radiological materials.
This fact sheet summarizes the December 2014 U.S. Geological Survey (USGS) report ***Background Groundwater Quality, Review of 2012-14 Groundwater Data, and Potential Origin of Radium at the West Lake Landfill Site, St. Louis County, Missouri.***

The report reviews WLL's complex geology to determine whether radiologically impacted material (RIM) illegally placed in WLL is dissolving into the groundwater at rates that impact groundwater quality. The review focuses on the drinking water standard for combined radium. Radium is the only radionuclide found dissolved in the groundwater at WLL in concentrations above its Maximum Contaminant Level (MCL).

For the report, the U.S. Environmental Protection Agency (EPA) asked the USGS to:

1. Review recent groundwater data (2012-14) to identify:
    a. Monitoring wells affected by landfill leachate.
    b. The potential origin of combined radium (radium 226 and 228) above the MCL of 5 picocuries per liter (pCi/L).
2. Review and summarize historical and background groundwater data for comparison to current data.

Landfill leachate from WLL and Bridgeton Landfill potentially causes radium to dissolve into groundwater from:

- Rocks or soil particles that naturally contain radium.
- Non-RIM wastes that naturally contain radium, such as concrete, clay bricks, cement, tiles, gypsum and fertilizers.
- RIM illegally placed at WLL in the 1970s.

The report concluded that:

- Water quality in the region is variable. About 50 percent of wells do not yield water fit to drink.
- Determining the source of radium in groundwater at WLL is limited by the small amount of background data available.
- There is also not enough current data available to determine the source of the dissolved combined radium above the MCL in groundwater at most WLL locations. The report states that it is unlikely that RIM accounts for all the radium found in the groundwater at WLL.
- Radium in monitoring well PZ-101-SS (see Figure 1 on page 4) may have the greatest potential to be related to RIM. It has the largest amounts of combined radium, there are leachate effects and the dissolved radium at this location is mostly radium 226, as is the RIM in WLL.

Report Conclusions Summary

The USGS report included 16 concluding statements (pages 41-46), which are summarized below. For more detailed information, please see the USGS report: http://www.epa.gov/region07/cleanup/west_lake_landfill/pdf/west-lake-usgs-gw-rpt-12-17-14.pdf.

1. Ground water in St. Louis County and near WLL contains highly variable amounts of dissolved solids and naturally occurring contaminants. About 50 percent of wells completed in the 1900s yield potable water (drinkable water).

2. Groundwater at WLL flows toward the Missouri river as well as upward from deeper bedrock towards the shallower alluvium (materials deposited by the river over time). Groundwater pumping at the Bridgeton Landfill may have locally reversed natural groundwater flow in the bedrock, but groundwater from deeper bedrock under the floor of the former quarry still flows upward.

3. Forty seven of 83 groundwater wells at WLL are affected by landfill leachate, defined by increased concentrations of chloride, bromide, iodide, calcium, magnesium, sodium, potassium, barium, iron, manganese, strontium, total alkalinity (hardness) and dissolved radium.

4. Several monitoring wells around the North and South quarry areas of the Bridgeton Landfill remain affected by landfill leachate, despite leachate pumping.

5. The small amount of background data on radionuclide concentrations in groundwater near WLL limits understanding of the origin of radium in groundwater. (Seven samples from four wells for bedrock groundwater and 11 samples from eight wells for alluvial groundwater).

6. Concentrations of dissolved and total combined radium in groundwater samples from WLL were significantly larger than background. About 20 percent of the groundwater samples (64 of 314) contained dissolved combined radium concentrations above the MCL for drinking water. These 64 samples were from 31 wells.

7. There is not enough data to determine why dissolved combined radium is above the MCL in groundwater at WLL. The radium could be leaching from: a) RIM placed at the site in the 1970s; b) non-RIM wastes at the site; or c) naturally occurring radium in the aquifer solids.

8. A combination of mechanisms across WLL are likely causing the high levels of dissolved radium in groundwater.

9. Radium leached from RIM is likely not the main source of radium concentrations above the MCL in groundwater at WLL; the RIM contains mostly radium 226 and the groundwater contains significant amounts of radium 228.

10. There is not strong evidence that RIM areas are releasing substantial quantities of radium to groundwater. Several monitoring wells downgradient (downstream) of RIM have landfill leachate effects, but do not have radium above the MCL. Also, there is radium above the MCL in groundwater with no connection to RIM areas.

11. Of 83 groundwater monitoring wells sampled at WLL from 2012 to 2014, 13 had average dissolved combined radium above the MCL. Radium in six of the 13 wells is probably not the result of leaching from RIM. There is not enough data to determine if there is a RIM contribution from the other seven wells.

12. Radium concentrations above the MCL will likely remain commonplace at WLL. This is because landfill leachate can dissolve radium into groundwater from RIM, non-RIM wastes and naturally occurring solids in the aquifer.

13. Radium in monitoring well PZ-101-SS (see Figure 1 on page 4) may have the greatest potential to be related to RIM. Runoff from Area 1 could have brought RIM into the shallow North quarry of Bridgeton Landfill between PZ-

101-SS and Area 1, or even into lower areas of the South quarry. This would possibly affect wells PZ104-SD and MW 1204, which also have average dissolved combined radium above the MCL. In addition, pumping from leachate riser LSC-5A (see Figure 1 on page 4) about 200 feet southwest from well PZ-101-SS could result in PZ-101-SS being along a flow path between the riser and RIM Area 1.

14. Leaching of radium from more "traditional" non-RIM wastes landfilled at WLL may contribute to radium above the MCL in some groundwater samples from WLL, particularly wells with dissolved combined radium less than about 10 pCi/L. The report compared radium in leachate from the Bridgeton Landfill to radium in leachate from a Pennsylvania landfill that did not accept RIM. The similar total combined radium concentrations and radium 228 to radium 226 ratios in leachate from the two landfills indicate that the presence of RIM at WLL could be due to leaching from more traditional wastes at the site.

15. Available data indicates that landfill leachate is probably causing naturally occurring radium in the aquifer to dissolve, causing dissolved combined radium concentrations above the MCL in the groundwater.

16. There is no data from individual leachate risers in the North and South quarry areas of the Bridgeton Landfill, from leachate collection points within RIM areas, and from landfilled materials between RIM and underlying subsurface soils. Such data could provide more conclusive evidence of the potential movement of radium from RIM areas compared to leachate collected from non-RIM areas. Data were not available from leachate risers at various locations and depths within the Bridgeton Landfill. These missing data could identify variations in radium within leachate discharged from the facility and possible differences in radium from various depths in the landfilled waste.

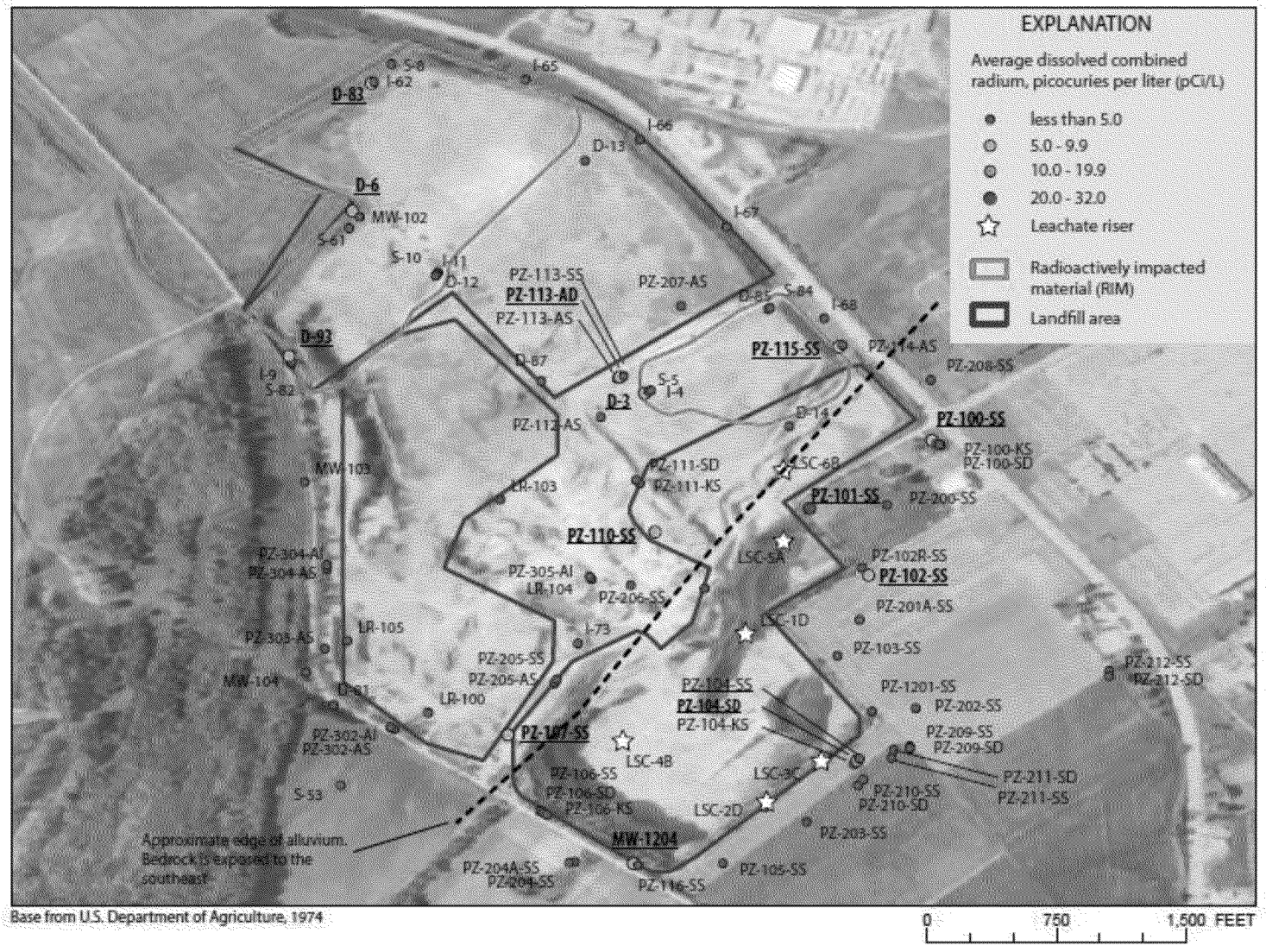

Figure 1: Dissolved Radium Exceedances of MCLs during 2012 and 2013 Sampling Events (wells with average dissolved combined radium values above the MCL underlined and in bold) (Figure 13 from the USGS report)